Lightenning electron tracks for input to CabanaBoy

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Introduction

Motivations :

- Use CabanaBoy to analyse run7 dielectron data,
- Need to consider reaction plane pools.

Difficulties :

- CabanaBoy usage requires running memory consuming analysis,
- Unable to run with the needed event pooling[1] (pools in vertex, centrality & reaction plane) and histograms.

This problem was already encountered by other analysis groups. For example, the dimuon folks decided to solve it by :

1. Implementing the MultiAkibaPool mixing scheme. The mixing is done in n pools times m subpools (mixing in $N = n \times m$ classes), but the histograms are just kept for n pools. Matt Wysocki subpools :

   https ://www.phenix.bnl.gov/cdsagenda//fullAgenda.php ?ida=a07502
2. Defining lighter muon tracks for input to CabanaBoy. Hugo's MWGLight package : *https ://www.phenix.bnl.gov/WWW/p/draft/hpereira/doc/MWGLight/html/index.html*

Combined, these allowed to use CabanaBoy to extract dimuon background for J/ψ v_2 analysis.

[1] Roughly, the pools define the event classes/characteristics in which tracks can be mixed.

What’s up for central arm analysis ?

The ingredients :

- The pools : this MultiAkibaPool mixing scheme is completely general and useful for all PHENIX analysis. $\surd$
- Lightenning tracks :
  - There exists an UltraLight package in *offline/AnalysisTrain/UltraLight/*
  - I decided to follow the muonners steps and implement electron light tracks.

Electron light package in a few words : $\surd$

- Clearly inspired from MWGLight muon package,
- The aim is to create light-weighted nanoDST objects
- How does it work ? The idea :
  1. Input tracks are PHCentralTracks,
  2. Apply electron identification cuts defined in a CabanaBoyCutter like class,
  3. Convert the identified electron tracks into lighter tracks,
  4. Feed those light tracks into CabanaBoy. (Now, only the pair cuts need to be applied by the CabanaBoy module).
- Documentation by doxygen at :

  https ://www.phenix.bnl.gov/WWW/p/draft/zconesa/docs/EWGLight/index.html

Package description

Class package hierarchy :

- EWGLightTracks,
  - The container (virtual base class)
  - Derive from PHParticle so that they can be directly used in CabanaBoy,
  - EWGLightTracks_v1, (first implementation).
- EWGLightTrack,
  - The contained classes (virtual base class),
  - Derive from TObject,
  - EWGLightTrack_v1 (first implementation),
  - The ’tracks evolution’ does not necessarily imply the ’container evolution’.
- EWGLightConvert converts the input PHCentralTrack tracks into light tracks.
  - Optimized to work from EWGCentralTracks,
  - Select the tracks via some criteria defined by a cutter.

Extra needed classes :

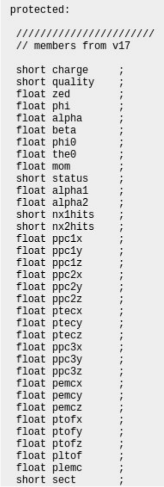
- DielectronCutterBase,
  - Dielectron cutter (virtual base class),
  - Derive from cbMasterCutter class,
  - A derived class is used by EWGLightConvert, EWGDielectronCutterRun7AuAu.
- Others : usual cutter and histogramer needed for CabanaBoy.

Allow future changes to the track class in backward compatibility.

Input tracks description

Only the variables that define the track and those needed for the pair cuts need to be kept.

PHSnglCentralTrack_v22



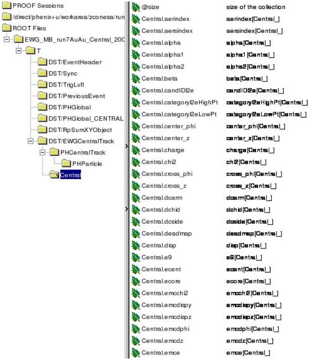
```
protected:

  ///////////////////////
  // members from v17

  short charge     ;
  short quality    ;
  float zed        ;
  float phi        ;
  float alpha      ;
  float beta       ;
  float phi0       ;
  float the0       ;
  float mom        ;
  short status     ;
  float alpha1     ;
  float alpha2     ;
  short nx1hits    ;
  short nx2hits    ;
  float ppc1x      ;
  float ppc1y      ;
  float ppc1z      ;
  float ppc2x      ;
  float ppc2y      ;
  float ppc2z      ;
  float ptecx      ;
  float ptecy      ;
  float ptecz      ;
  float ppc3x      ;
  float ppc3y      ;
  float ppc3z      ;
  float pemcx      ;
  float pemcy      ;
  float pemcz      ;
  float ptofx      ;
  float ptofy      ;
  float ptofz      ;
  float pltof      ;
  float plemc      ;
  short sect       ;
```

. . .

EWGCentralTrack



```
PROOF Sessions
/direct/phenix+u/workarea/zconesa/run
ROOT Files
  EWG_MB_run7AuAu_Central_200
    T
      DST/EventHeader
      DST/Sync
      DST/TrigLvl1
      DST/PreviousEvent
      DST/PHGlobal
      DST/PHGlobal_CENTRAL
      DST/RpSumXYObject
      DST/EWGCentralTrack
        PHCentralTrack
          PHParticle
        Central
```

@size	size of the collection
Central.aerindex	aerindex[Central_]
Central.aersindex	aersindex[Central_]
Central.alpha	alpha[Central_]
Central.alpha1	alpha1[Central_]
Central.alpha2	alpha2[Central_]
Central.beta	beta[Central_]
Central.candIDl2e	candIDl2e[Central_]
Central.categoryl2eHighPt	categoryl2eHighPt[Central_]
Central.categoryl2eLowPt	categoryl2eLowPt[Central_]
Central.center_phi	center_phi[Central_]
Central.center_z	center_z[Central_]
Central.charge	charge[Central_]
Central.chi2	chi2[Central_]
Central.cross_phi	cross_phi[Central_]
Central.cross_z	cross_z[Central_]
Central.dcarm	dcarm[Central_]
Central.dchid	dchid[Central_]
Central.dcside	dcside[Central_]
Central.deadmap	deadmap[Central_]
Central.disp	disp[Central_]
Central.e9	e9[Central_]
Central.ecent	ecent[Central_]
Central.ecore	ecore[Central_]
Central.emcchi2	emcchi2[Central_]
Central.emcdispy	emcdispy[Central_]
Central.emcdispz	emcdispz[Central_]
Central.emcdphi	emcdphi[Central_]
Central.emcdz	emcdz[Central_]
Central.emce	emce[Central_]

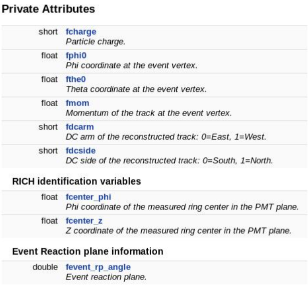
. . .

both with ∼ 191 variables

$\Longrightarrow$

eID cuts

EWGLightTrack_v1 class members



Private Attributes

short	**fcharge** *Particle charge.*
float	**fphi0** *Phi coordinate at the event vertex.*
float	**fthe0** *Theta coordinate at the event vertex.*
float	**fmom** *Momentum of the track at the event vertex.*
short	**fdcarm** *DC arm of the reconstructed track: 0=East, 1=West.*
short	**fdcside** *DC side of the reconstructed track: 0=South, 1=North.*

RICH identification variables

float	**fcenter_phi** *Phi coordinate of the measured ring center in the PMT plane.*
float	**fcenter_z** *Z coordinate of the measured ring center in the PMT plane.*

Event Reaction plane information

double	**fevent_rp_angle** *Event reaction plane.*

9 variables

(8 for the track +1 for the rxpn)

Developement status

Good news :

- The code is compiling and running,
- Allows to consider reaction plane pools and more histograms (and/or finner binning) in the analysis,
- Checked with a few events ($\sim$ 1 EWG) that we get the same results than using PHCentralTracks,
- It is robust and user friendly,
- Allows to save those light track objects in root files (if needed).

Caveats :

- The jobs launched on the RCF farm :
  - do run but (still) with some (usual) memory restrictions,
    Configuration of $(10, 1, 1)$ pools $\times(2, 30, 18)$ subpools runs at RCF !
  - get evicted if the number (& binning) of histograms and pools is not optimized.
- Checks with valgrind
  - ends up when launched with not many pools, ex $(10, 1, 1)$ pools $\times(1, 30, 1)$ subpools /direct/phenix+u/workarea/zconesa/run7AuAu/CabanaBoy/MultiAkibaPools_EWGLight/Lighter_10-1-1_1-30-1_valgrind.log
  - ends up with some errors (under investigation),
  - ends up with few kB's of definitely memory lost.
- Check with insure : to be done

Add-ons

Disclaimer :

- I named the package EWGLight,
- I did it electron wise/specific,
- Might still need of finishing/further developement.

Comments and questions :

- Feel free to comment on naming and particularities,
- I would like to commit it, but where ? Which would be the best place : offline/packages, offline/AnalysisTrain, . . . ?
- If anybody wants to play with I would be happy to help,
- **Any input will be most welcome !**